

Amendment Under 37 C.F.R. § 1.111
U.S. Application No. 10/677,241

AMENDMENTS TO THE DRAWINGS

Figures 2 and 3

Attachment: Replacement Sheet(s)

REMARKS

Claims 1-6, all the claims pending in the application, stand rejected. Claims 1-6 have been amended.

Drawings

The drawings are objectionable for several reasons. First, in Fig. 2, the Examiner asserts that the dotted image should have a reference number. The dotted rectangle should be labeled with the number 13, as is the sensor screen. Second, the Examiner asserts that in Fig 3, the elements should have reference numbers. In particular, the reference number 12 is required to indicate that this is an example of the x-ray source as shown in Fig. 2.

Applicants have added reference number as required. New Figs. 2 and 3 are being submitted.

Specification

The Examiner objects to the specification because the word “blue” is used instead of the word “blur.” Correction is required. Applicants have identified only a single instance in the specification of this typographical error. Accordingly, Applicants have amended the specification at page 24, line 16 (last full paragraph) to correct the error. The Abstract also has been amended.

Claim Objections

Claims 2, 4 and 6 are objected to because the phrase “blue amounts” should be “blur amounts.” This basis for objection has been removed by amendment to the claims.

Claim Rejections – 35 USC 112

Claims 1-6 are rejected under 35 USC 112, second paragraph, as being indefinite. This rejection is traversed for at least the following reasons.

In claims 1, 3 and 5, the Examiner suggests that “first detection data and second detection data” should be “first set of detection data and second set of detection data” in order to have proper antecedent basis. The Examiner’s suggestion is appropriate, particularly in view of the

teachings at page 15 of the specification with regard to Figs. 1, 2 and 4 and the description of step S10. Thus, they have been adopted.

Similarly, the Examiner states that “the detection data in which blur amount has been corrected” should be “the set of detection data in which blur amount has been corrected” in order to have proper antecedent basis. The Examiner’s suggestion is appropriate, particularly in view of the teachings at page 18 with regard to step S12, even though the disclosure simply refers to detection data, although the reference to $I(x, y, z_1)$ and $I(x, y, z_2)$ clearly contemplates “sets.”. Thus, the Examiner’s suggestions have been adopted.

The Examiner states with regard to claims 2, 4 and 6 that “a focal size of a radiation source in said plural sets of detection data” is unclear because it implies that there is only one focal size for the radiation source in the plurals sets of detection data. The Examiner observes that Fig 2 of the application implies that the focal size in each set of detection data changes as the distance from the radiation source 12 to the detection plane 13 changes. The Examiner makes no suggestion, but this phrase has been changed in order to remove the basis for rejection.

Claim Rejections – 35 USC 101

Claims 5 and 6 are rejected under 35 USC 101 because the claimed invention is directed to non-statutory subject matter. This rejection is traversed for at least the following reasons.

The Examiner notes that claims 5 and 6 recite a computer program per se, which is not embodied in a computer readable medium. Under current U.S. law, the Examiner is correct and the claims have been changed to claim a program product containing a computer readable program.

Claim Rejections – 35 USC 103

Claims 1-6 are rejected under 35 USC 103(a) as being unpatentable over “Hard X-ray Quantitative Non-Interferometric Phase-Contrast Imaging” by Gureyev et al, SPIE vol. 3659, Feb 1999, pp 356-364 (Gureyev) in view of Ishisaka et al (6,404,848). This rejection is traversed for at least the following reasons.

The invention is directed to a method of, and apparatus for, restoring phase information of radiation transmitted through an object, particularly soft tissue in a human body. The phase difference for radiation transmitted through an object is converted into brightness so that differences in soft tissue can be identified. A diffraction fringe pattern, which is generated due to images formed at different distances by radiation from a uniform phase source, is used, and the principle is illustrated in Fig. 9 of the present application. However, a problem occurs with a blur factor that varies with distance, as explained at pages 6 and 7 of the specification.

The method and apparatus each includes a function of correcting blur for at least one or plural sets of detection data, the data of each set being obtained by detecting intensity of radiation on plural detection planes at different distances from the object. According to the method and apparatus inventions, a difference is then obtained between first and second data sets, where at least one has blur correction. A Laplacian of phase is then obtained, on the basis of (1) the differential data, (2) any one of the plural sets of detection data, and (3) the detection data in which the blur amount has been corrected. Finally, phase data is obtained by performing inverse Laplacian on the Laplacian of phase.

Gureyev

As to claims 1, 3 and 5, the Examiner admits that blur correction, which is a primary focus of step (a) of the claimed method and the “blur compensating means of the claimed apparatus, is not disclosed in Gureyev. This is consistent with the observations of the inventors at pages 5-7 of the specification in the present application. Indeed, nothing in Gureyev even suggests that there is an appreciation of the cause for, and certainly no appreciation for a solution to, the blur problem. Thus, none of the subsequent steps in claims 1 and 5, or the functions in claim 3 that expressly consider or are based upon blur correction are disclosed in Gureyev.

The Examiner asserts that Gureyev discloses in the Abstract and in Figs. 1 and 2 that there are “plural sets of detection data obtained by detecting intensity of radiation on plural detecting planes at different distances for the object,” as claimed. This assertion is not supported by the cited teachings as there is no disclosure or discussion of the blur factor or its effect for radiation at multiple distances. The illustration in Figs. 1 and 2 merely concern a distance

relationship among source, object and detector. Rotation is considered, as illustrated in Figs. 7 and 8, but z-distance changes are not disclosed. Differences in z-planes is mentioned at page 361, but there is no teaching that both images are used in the manner claimed, and certainly not with blur compensation. Thus, the Examiner's assertion is not correct and the rejection must fail.

With apparent reference to step (b) of claims 1 and 5, and the function in the "difference processing means of claim 3, the Examiner also asserts that Gureyev discloses at page 357 "obtaining differential data representing a difference between first and second sets of detection data." However, this assertion ignores the additional limitation that the detection data must also consider data in which the blur amount has been corrected. First, as already noted, there is no consideration of different distances and, thus, no consideration of first and second data, as defined in the claims. Second, there is no consideration of blur corrected data, nor any reason to consider such data in addition to difference data. Thus, Gureyev is wholly inadequate to form a basis for obviousness of the claimed invention.

With apparent reference to steps (c) and (d) of the method of claims 1 and 5, and the function of the means in apparatus claim 3, the Examiner further asserts that the obtaining of Laplacian of phase and obtaining phase data by performing inverse Laplacian computation is taught at pages 357 and 360. First, Applicants would disagree, as there is no mention of Laplacian computation on the basis of three factors, including (1) differential data, (2) any one of the plural sets of detection data, and (3) detection data in which blur amount has been corrected, at those pages of the reference. Even if the disclosure would be interpreted to teach Laplacian computation in general, there is no teaching or suggestion as to how or why the three factors, especially blur factors, should be considered together. Further, there is no teaching or suggestion of a use of an inverse of the Laplacian computation, based on blur factors, as in step (d).

Ishisaka

As previously noted, The Examiner admits that Gureyev does not disclose correcting blur amount and looks to Ishisaka for such teaching, particularly at col. 4, lines 24-29 with reference to "making edge enhancement generate simultaneously to eliminate blur." The Examiner asserts that it would have been obvious to include the blur correction of Ishisaka with the phase-contrast

imaging of Gureyev because by eliminating the blur, a radiographing image having the excellent sharpness is obtained” as taught at col. 4, lines 24-29 of Ishisaka.

First, the Examiner’s observation of the broad and general consideration of blur in Ishisaka does not support the more specific application of blur correction into the specific steps of Gureyev. Nothing in Ishisaka teaches that Gureyev should be modified to consider blur and, in particular, that Gureyev should be modified in the manner claimed. As already noted, Gureyev is deficient in considering, not only blur in general, but the effect of blur on different data sets based on distance. Second, there is no teaching as to how Gureyev would be modified to consider blur, and arrive at the claimed invention. Third, the focus of Ishisaka is only on edge enhancement to eliminate blur. However, there is no teaching or suggestion for the calculation of phase data using blur compensation in the manner claimed for all of the recited steps.

Because of the clear difference between the claimed invention and the prior art, and the absence of express limitations from the prior art and the absence of any teaching or suggestion to modify Gureyev on the basis of Ishisaka, the rejection of the claims, as amended to overcome the indefiniteness rejections, should be withdrawn.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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